1. INTRODUCTION TO THE REGIONAL HAZE RULE REQUIREMENTS

1.1. Purpose of the Plan

To protect visibility in national parks and scenic areas, the United States Environmental Protection Agency (U.S. EPA) adopted the Regional Haze Rule in 1999. The Rule lays out specific requirements to ensure improvements in the anthropogenic components of visibility at 156 of the largest national parks and wilderness areas across the United States. The vast majority of these areas are in the West (118), with 29 in California, including such national treasures as Yosemite and Sequoia National Parks. The Rule sets out a long-term path towards attaining improved visibility, with the goal of achieving visibility which reflects natural conditions by 2064. Unlike State Implementation Plans which require specific targets and attainment dates, the Regional Haze Rule requires states to establish a series of interim goals to ensure continued progress. This Regional Haze Plan (Plan) addresses the first interim goal period of 2018.

This Plan sets forth California's visibility goals and represents California's element of a multi-state western regional effort to assess the visibility improvement that is expected to occur through 2018. Due to the regional nature of haze, multi-state planning organizations were established to provide for coordinated technical planning and consultation. The Western Regional Air Partnership (WRAP) serves this function in the West. California has worked extensively with the WRAP over the last five years in preparing this Plan. Technical tool development, emission inventories, and air quality modeling have been conducted on a regional basis by the WRAP to support the efforts of all of the western states.

The technical analysis conducted by the WRAP has shown that by 2018 visibility will improve in all areas of the West. However, the greatest improvements will occur in California due to the extensive nature of our control programs to achieve ambient air quality standards which have gone far beyond what has been achieved on a national level. To document the co-benefits of these programs for visibility, and to meet the requirements of the Regional Haze Rule, the Air Resources Board (ARB) has prepared this first Plan for California. The Plan evaluates the nature of the visibility problem at each Class 1 Area in the State, demonstrates the progress that will be achieved in each area by 2018, and describes how this progress is occurring within the framework of California's comprehensive control programs.

1.2. Overview of Visibility and Regional Haze

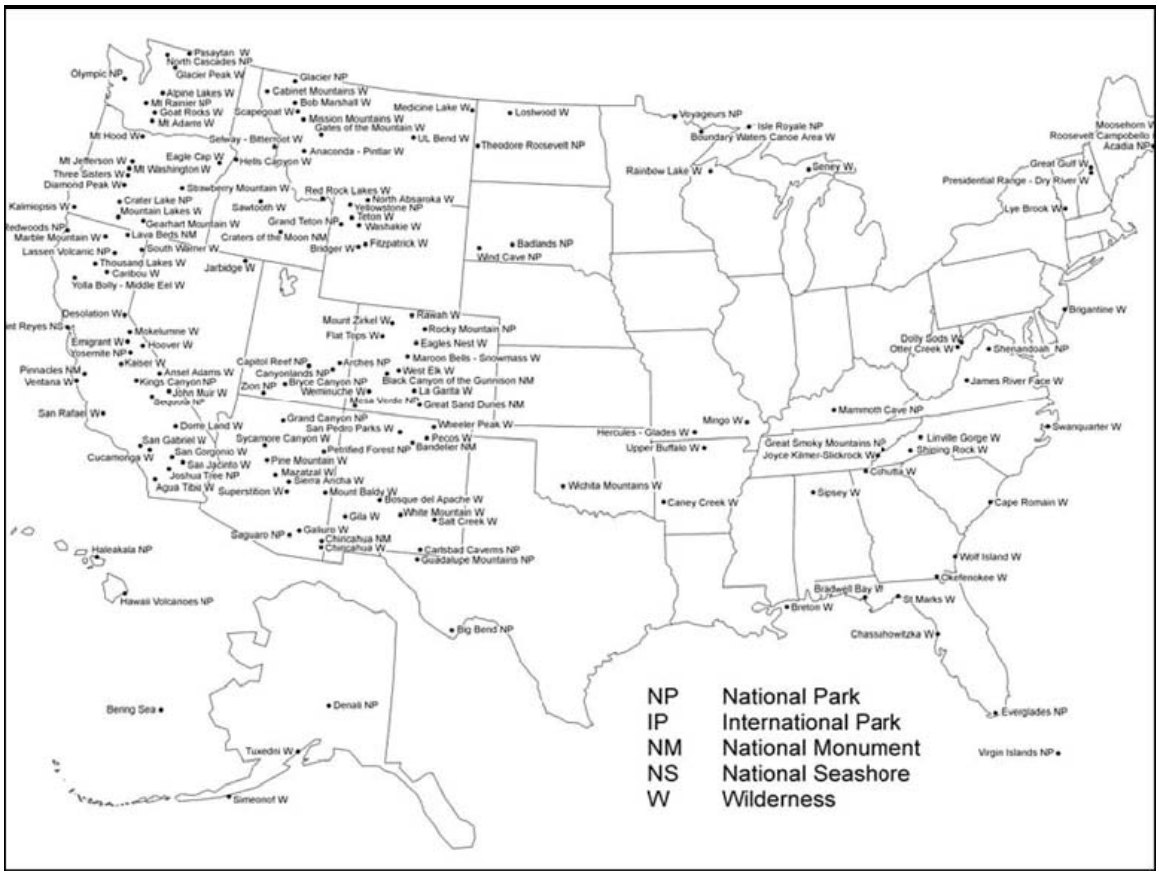
Good visibility is essential to the enjoyment of national parks and scenic areas. Across the United States, regional haze has decreased the visual range in these pristine areas from 140 miles to 35-90 miles in the West, and from 90 miles to

15-25 miles in the East. This haze is composed of small particles that absorb and scatter light, affecting the clarity and color of what humans see in a vista. The pollutants (also called *haze species*) that create haze are measurable as sulfates, nitrates, organic carbon, elemental carbon, fine soil, sea salt, and coarse mass. Anthropogenic sources of haze include industry, motor vehicles, agricultural and forestry burning, and dust from soils disturbed by human activities. Pollutants from these sources, in concentrations much lower than those which affect public health, can impair visibility anywhere. Natural forest fires, biological emissions, sea salt and other natural events also contribute to haze species concentrations. Visibility-reducing particles can be transported long distances from where they are generated, thereby producing regional haze. But when they are transported to and occur in national parks and wilderness areas, the reduced visibility impairs the quality and the value of the wilderness experience.

The national visibility goal set forth in section 169A of the federal Clean Air Act is to remedy existing degraded visibility and prevent future visibility impairment in national parks and wilderness areas. U.S. EPA first promulgated visibility rules in 1980. In July 1999, EPA adopted the Regional Haze Rule to complement and add to the visibility rules. These rules apply to 156 national parks and wilderness areas designated by Congress as “mandatory federal Class 1 Areas” (referred to herein as Class 1 Areas). Figure 1.1 shows that most of these are located in the western states, with 29 Class 1 Areas in California as illustrated in Figure 1.2. California Class 1 Areas span all regions of the State, from Joshua Tree National Park in the south, to Yosemite National Park in the Sierras, and Redwoods National Park on the northern coast.

The Regional Haze Rule sets forth the goal of achieving natural visibility conditions by 2064 in all Class 1 Areas. Along that path, states must establish a series of interim goals to ensure continued progress. The first planning period specifies setting reasonable progress goals for improving visibility in Class 1 Areas by the year 2018. Specifically, the interim goals must provide for improved visibility on the 20 percent of days with the worst visibility, and ensure that there is no further degradation on the 20 percent of days with the best visibility. The intent is to focus on reducing anthropogenic emissions, while achieving a better understanding and quantification of the natural causes of haze.

Figure 1-1 Nationwide Class 1 Areas



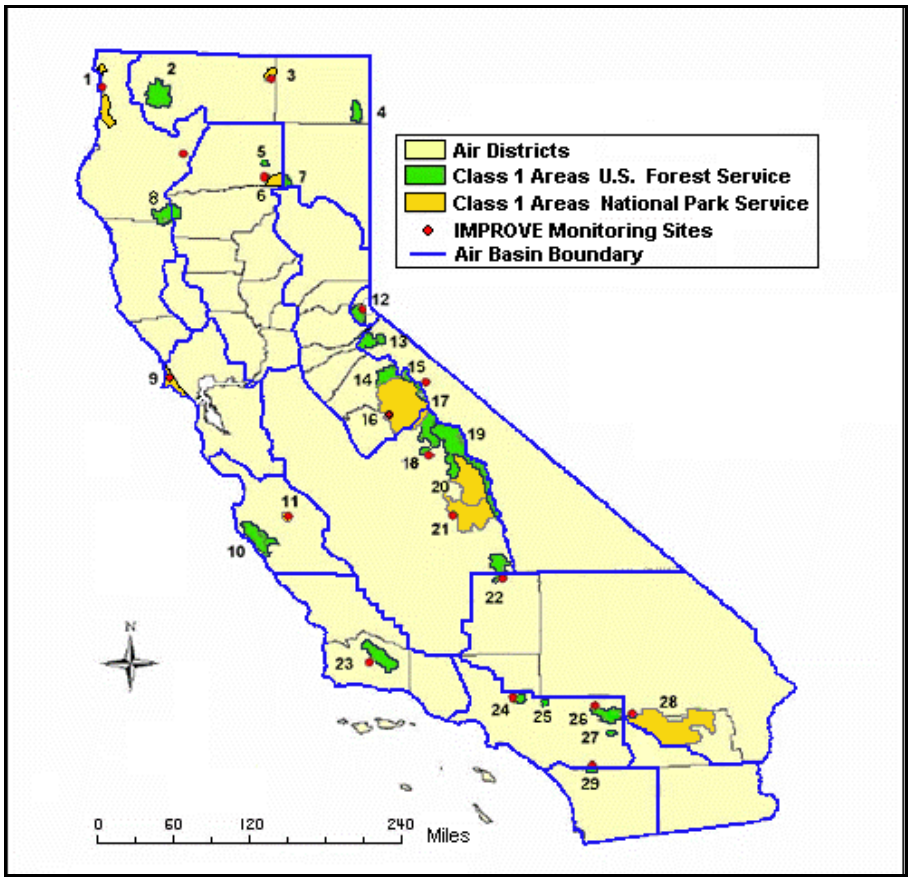
1.3. California and the Federal Regional Haze Rule

California has a long history of pollution control efforts to meet the health-based air quality standards. The numerous federal nonattainment areas within the State, as well as requirements to address more stringent State air quality standards have kept California at the forefront of pollution control. Due to the unique challenges faced in California, our pollution control programs have gone far beyond what has been achieved on a national level. California has also pioneered programs to address issues such as health risk from diesel exhaust, mitigating the impacts from good movement within the State, and most recently climate change. As a result, California has made tremendous progress in reducing emissions and improving air quality.

Visibility improvement reflects an additional aspect of environmental protection in California that benefits from the broad spectrum of programs already underway. Examination of visibility data from a number of sites with long-term monitoring demonstrates that California's control programs are providing visibility benefits. For example, at the San Gorgonio Class 1 Area, a wilderness area just downwind of the South Coast Air Basin, visibility has improved approximately 15 percent between 1990 and 2004, while at Pinnacles National Monument on

the Central Coast, visibility has shown an approximately 18 percent improvement over the same time period.

Figure 1-2 California's Class 1 Areas and IMPROVE Monitoring Network



1. Redwood National Park
2. Marble Mountain Wilderness
3. Lava Beds National Monument
4. South Warner Wilderness
5. Thousand Lakes Wilderness
6. Lassen Volcanic National Park
7. Caribou Wilderness
8. Yolla Bolly Middle Eel Wilderness*
9. Point Reyes National Seashore
10. Ventana Wilderness
11. Pinnacles National Monument
12. Desolation Wilderness
13. Mokelumne Wilderness
14. Emigrant Wilderness
15. Hoover Wilderness
16. Yosemite National Park
17. Ansel Adams Wilderness
18. Kaiser Wilderness
19. John Muir Wilderness
20. Kings Canyon National Park
21. Sequoia National Park
22. Dome Land Wilderness*
23. San Rafael Wilderness
24. San Gabriel Wilderness
25. Cucamonga Wilderness
26. San Gorgonio Wilderness
27. San Jacinto Wilderness
28. Joshua Tree National Park
29. Agua Tibia

**also includes land managed by the U.S. Bureau of Land Management*

As noted earlier, this Plan represents California's element of a broader regional effort to improve visibility throughout the West through our participation in the WRAP. The WRAP facilitates the regional planning process and interstate consultation for the western states of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming. The WRAP established stakeholder-based technical and policy oversight committees to assist in managing the development of regional haze work products. Working groups and forums were also established that included states, tribal representatives, federal agencies, environmental groups, and industry stakeholders. ARB staff actively participated in the research, data analyses, interstate and tribal coordination, and discussions which led to regionally consistent emissions and air quality modeling approaches for addressing regional haze amongst all the western states.

The Regional Haze Rule contains many technical and informational elements which must be included in the Plan. These key elements include:

- Determining baseline and natural visibility conditions,
- Presenting base and future year emission inventories,
- Setting reasonable progress goals for 2018,
- Documenting the strategy to attain these goals,
- Determination of best available retrofit technologies,
- Consultation with states, tribes, and federal land managers,
- Committing to a monitoring strategy, and
- Specifying a timeline for future Plan revisions.

These elements are briefly explained in this Chapter and then detailed in subsequent Chapters of this document. Appendix J outlines the location of all of the elements that must be included in the Plan.

1.3.1. Determining Baseline and Natural Visibility Conditions

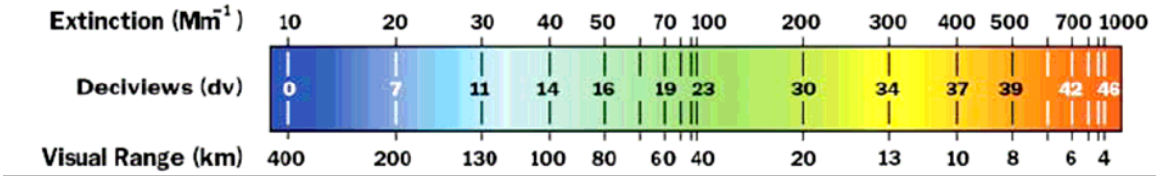
For each Class 1 Area in California, the state must describe existing (current) visibility conditions, on the suite of days with the best and worst visibility, for the baseline years of 2000-2004. The state must also establish what the best and the worst visibility would be like under natural conditions during the baseline period, on days when only natural sources affect visibility, without any anthropogenic impairment. Achieving natural conditions for visibility on worst days by 2064 is the overall goal of the Regional Haze Program.

Establishing the link between haze species and visibility impairment is the key to understanding regional haze. The haze species reflect (scatter) and absorb light in the atmosphere, thereby extinguishing light. The amount of light extinction affects visibility or the clarity of objects viewed at a distance by the human eye. The amount and type of haze species in the air can be measured, and the amount of light extinction caused by each one can be calculated, for any location

or day, as visibility conditions change from good to poor throughout the year. The specific visibility measurement unit, the deciview (dv), is the natural logarithm of light extinction. The deciview is used in the Regional Haze Rule to track visibility conditions. While the deciview value describes overall visibility levels, light extinction describes the contribution of particular haze species to measured visibility.

The relationship between units of light extinction (Mm^{-1}), haze index (dv), and visual range (km) are indicated by the scale below. Visual range is the distance at which a given object can be seen with the unaided eye. The deciview scale is zero for pristine conditions and increases as visibility degrades. Each deciview change represents a perceptible change in visual air quality to the average person. Generally, a one deciview change in the haze index is likely perceptible by a human regardless of background visibility conditions. This is approximately a 10 percent change in the light extinction reading.

Figure 1-3 Visibility Measurement Scale



As the scale indicates, the deciview value gets higher as the amount of light extinction increases. The ultimate goal of the regional haze program is to reduce the amount of light extinction caused by haze species from anthropogenic emissions, until the deciview level for natural conditions is reached. That would be the deciview level corresponding to emission levels from natural sources only. The haze species concentrations are measured as part of the IMPROVE (**I**nteragency **M**onitoring of **Pro**tected **V**isual **E**nvironments) monitoring network deployed throughout the United States. Seventeen sites are operated in California.

Baseline or current visibility includes haze pollutant contributions from anthropogenic sources as well as those from natural sources using the actual pollutant concentrations measured at the IMPROVE monitors every three days during the period of 2000-2004. The 20 percent highest deciview days (roughly corresponding to the 24 days having the worst visibility) are averaged each year. These five yearly values are then averaged to determine the worst days visibility in deciviews for the 2000-2004 baseline period. The same process is used to get the best day baseline visibility value in deciviews from the annual 20 percent best days over the baseline years.

Natural visibility conditions represent the long-term degree of visibility estimated to exist, in the absence of anthropogenic impairment. Natural events such as wind storms, wildfires, volcanic activity, biogenic emissions from natural plant processes, and even sea salt from sea breezes introduce particles from natural sources that contribute to haze in the atmosphere. Therefore, individual natural events can lead to high short-term concentrations of visibility-impairing pollutants. Establishing the best and worst days under natural conditions represents a statistical normalization of these episodic events over time.

The U.S EPA initially calculated default natural visibility conditions for all Class 1 monitors but allowed states to develop more refined calculations. The Regional Planning Organizations nationwide funded research to refine the methods used to calculate visibility, the results of which were used to calculate the deciview values presented in this Plan. However, a great deal of additional research is underway to continue to better define natural visibility conditions in the western United States. New research is emerging on the increasing prevalence of wildfires in the western United States. The frequency of dust storms and their impact on areas disturbed by human-caused vs. wildlife activities is being investigated, as well as global transport of dust from natural desert storms in Africa and Asia. There is also increased awareness of the biogenic contributions to haze. As research into long-range transport, biogenic emissions, and wildfire cycles continues, we believe that natural condition visibility levels will be adjusted upwards.

Chapter 2 of this Plan describes current visibility conditions in each Class 1 Area as well as the nature of the pollutant species that contribute to the observed levels. Chapter 6 provides further information on the role of natural versus anthropogenic contributions and how that affects the progress that can be expected by 2018.

1.3.2. Statewide Emissions Inventory of Haze-causing Pollutants

As with any air quality analysis, a good understanding of the sources of haze pollutants is critical. The Plan includes emissions for the base year 2002, which represents the midpoint of the 2000-2004 baseline planning period, as well as future projected emissions to the year 2018. This emissions inventory was developed by the WRAP with input from California in order to provide a regionally consistent inventory. Chapter 3 provides information on emissions within California, including both natural and anthropogenic source categories.

1.3.3. 2018 Progress Strategy

The Plan also describes the strategy that provides the necessary emission reductions to achieve the reasonable progress goals established for each Class 1 Area within California, as well as for each Class 1 Area located outside California which may be affected by California emissions. The Regional Haze

Rule requires that the strategy consider ongoing air pollution control programs, measures to mitigate the impacts of construction activities, and smoke management programs. Emissions limitations, control measures, compliance schedules, replacement and retirement schedules, including their enforceability, must also be considered. Given California's need to attain both federal and State standards for pollutants affecting public health, we have a multi-faceted combination of aggressive programs that have been reducing criteria pollutant emissions for many years. California's strategy provides an ambitious and comprehensive basis for setting reasonable progress goals for the purpose of regional haze planning. Chapter 4 describes the measures included in California's 2018 Progress Strategy.

1.3.4. Best Available Retrofit Technology (BART) Requirement

The Best Available Retrofit Technology (BART) requirement implements a federal mandate to retrofit certain very old sources that pre-date the 1977 amendments to the Clean Air Act up to 15 years. The Plan must identify facilities that fall into one of 26 specific source categories, with emission units from the 1962-1977 time period having the potential to emit more than 250 tons per year of any haze pollutant. These emission units are known as BART-eligible sources. If it is demonstrated that the emissions from these sources cause or contribute to visibility impairment in any Class 1 Area, then the best available retrofit technology must be installed.

The determination of BART must take into consideration the costs of compliance, the energy and non-air quality environmental impacts of compliance, any existing pollution control technology in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology. In California, there are a number of facilities that fit the initial BART-eligible criteria. However, because local air districts have adopted stringent measures to reduce criteria pollutants, the vast majority of the older emission units have already been retrofit or suitably controlled. The systematic BART analysis carried out by ARB and the local air districts are detailed in Chapter 5.

1.3.5. Reasonable Progress Goals for 2018

Reasonable progress goals are established by each state for each Class 1 Area as a deciview level to be achieved by 2018, the end of the first planning period. The reasonable progress goals must assure that the worst haze days get less hazy *and* that visibility does not deteriorate on the best days, when compared with the baseline period. WRAP regional air quality modeling was used by the western states to assess future visibility and therefore, provide the context for states to establish reasonable progress goals for their Class 1 Areas.

States must also compare their reasonable progress goals to the level of visibility improvement that would be achieved if perfectly linear progress between the current period and expected natural conditions in 2064 were to occur. This linear rate of progress is known as the uniform glide path. The uniform glide path is not a fixed standard that must be met; instead it simply provides a basis for evaluating the selected 2018 goals. Many factors play into whether the uniform glide path can be achieved in the initial progress period including the cost and feasibility of controls as well as the appropriateness of the level set for natural conditions in 2064. Chapter 4 contains the analysis of control measures leading to California's selection of reasonable progress goals which are described in Chapter 7. Chapter 6 provides information on the WRAP modeling efforts and discussion of natural versus human-caused source contributions.

1.3.6. Required Consultation

Preparation of the Plan and selection of reasonable progress goals requires consultation between states, Federal Land Managers (FLMs), and affected tribes since haze pollutants can be transported across state lines, as well as international and tribal borders. In California, Class 1 Areas are managed primarily by the National Park Service (NPS) and the U.S. Forest Service (USFS.) The ARB has longstanding cooperative relationships with the NPS and the USFS, as well as with other Federal Land Managers within the State. During the preparation of this Plan, ARB formed a Steering Committee with the NPS, the USFS, and the U.S. EPA to discuss the components of the Plan. The draft Plan must be available to the Federal Land Managers at least 60 days before the public hearing on the final Plan. This allows time to identify and address any comments from the Federal Land Managers in the final Plan in advance of the Board hearing.

Participation in the WRAP has fostered a regionally consistent approach to haze planning in the western states and provided a sound mechanism for consultation. Through this process, the western states have agreed upon the overall goals being set for 2018 and the appropriateness of the strategies to achieve these goals for all Class 1 Areas in the region. The consultation process is explained in detail in Chapter 8.

1.3.7. Monitoring Strategy

The Plan also includes a monitoring strategy for measuring, characterizing, and reporting visibility impairment that is representative of all Class 1 Areas within the State. California uses the seventeen IMPROVE monitors whose locations are shown on Figure 1.2. Although there are twenty-nine Class 1 Areas in California, the IMPROVE monitors are located to give a reasonable indication of visibility in the respective regions where some of the Class 1 Areas are close to each other and share a monitor. Chapter 9 explains how California will continue to provide

monitoring information for visibility analysis, as well as emissions inventories, as required, to the U.S. EPA.

1.3.8. Mid-Course Review of Progress, Revisions, and Timelines

Following submittal of the initial Plan, and every ten years after that, a revised Plan must be submitted for the following ten year period. In the interim, each state is required to submit a 5-year progress report to the U.S. EPA. Inventory and monitoring data updates, as well as a progress report on emission reductions are prepared for the mid-course review. As in this initial Plan, at the mid-course review, California will also work and consult with other states through a regional planning process.

The mid-course review also allows each state to assess progress towards its reasonable progress goals. As explained in Chapter 4, California's strategy for improving visibility is related to ongoing activities to reduce emissions of criteria pollutants. While the current control measures and incentive programs for stationary, area, and mobile sources contribute measurably to reductions in haze, California is embarking on ever more stringent, far-reaching, and technology-forcing control efforts in the upcoming years to meet further national and State air quality standard requirements. The first mid-course review, anticipated to occur in 2012, will provide an opportunity to reassess progress in light of these continuing programs.